Perspectives in Communication, Embedded-Systems and Signal-Processing (PiCES)
ISSN: 2566-932X, Vol. 1, Issue 2, May 2017.

Exudate Extraction: A Review

Madhukar M, D Manjula , Ujwal Y, Deepthi J, Seshacharan S

Department of ECE, Jyothy Institute of Technology, Bengaluru, India

Abstract: Exudates are commonly found in the retinal areas of patients suffering from high diabetes. Improper diagnosis of exudates leads to blurriness in vision, and eventually to blindness. Many machine learning algorithms have been developed to extract exudates and at the same time estimate the area of spread. This paper deals with various algorithms proposed for exudate extraction.

Keywords: Exudates, Diabetes, Texture, Edge detection

I. INTRODUCTION

Some diabetic patients can have an eye disease called diabetic retinopathy. This is when high blood sugar levels cause damage to blood vessels in the retina. Blood vessels of retina can swell and leak or they can even get closed, stopping blood from passing through. All of these changes can steal the patient's vision.

There are two main stages of diabetic eye disease, proliferative diabetic retinopathy (PDR) and non-proliferative diabetic retinopathy (NPDR) [1]. PDR is the more advanced stage of diabetic eye disease. It happens when the retina starts growing new blood vessels called neovascularization. These new vessels often bleed into the vitreous. If they bleed a little, you might see a few dark floaters and if they bleed more, it might block all vision. NPDR is the early stage of diabetic retinopathy. With NPDR, tiny blood vessels leak, which makes the retina swell. When the macula swells, it is called macular edema. This is one of the reason why people with diabetes usually lose their vision. Also with NPDR, blood vessels in the retina can close off called macular ischemia. When that happens, blood cannot reach the macula. Tiny particles called exudates can form in the retina. This affects the vision. In case of NPDR, vision is found to be blurry.

Exudates are fluids, rich in protein and cellular elements that oozes out of blood vessels due to inflammation and gets deposited in nearby tissues causing blur vision. There are two types of exudates, hard exudates and soft exudates [2]. Hard exudates are made up of extracellular lipid which has leaked from abnormal retinal capillaries; hence there is often associated retinal oedema. Hard exudates will form a ring or 'circinate' pattern around the leaking vessels. Hard exudates are found principally in the macular region and as the lipids coalesce and extend into the fovea, vision can be severely compromised. Soft exudates are in extreme stages of Diabetic Retinopathy. In soft exudates we can see spots referred to as the cotton spots. The retinal pre capillary arterioles provision blood to the nerve fiber layer is clogged and associatively the native nerve fiber axons get swollen; thereby creating a cotton wool spot.

Digital color fundus images are widely used by ophthalmologists for detecting exudates.

II. EXISTING METHODOLOGY

In [3], the proposed algorithm follows the following steps: The input Fundus image is pre-processed and optic disc is removed and masked. Then masking of non-exudates like blood vessels and clots is done using modified region growing segmentation algorithm. Texture edge features are then extracted and the conclusion of whether the exudates are present or not is determined. Based on the output of application of Gabor filter, the image will be classified as exudates present or exudates absent.

The authors in [4] attempt to detect the exudates by pre-processing the input fundus image and further to Canny Edge Detector. Canny Edge Detector is an edge detection operator that uses a multi stage algorithm to detect a wide range of edges in the images. Then morphological process is conducted and features are extracted. It is then fed to CNN Classifier. Depending upon the image, the image is classified as Normal and Abnormal. If it is Abnormal then it is further classified into moderately suffered and highly suffered.

The proposed method in [5] is described as follows: firstly image acquisition is made and then the image is pre-processed. Further, blood vessels are segmented using conventional techniques and also Adaptive Median Thresholding is applied. The features are then extracted and performance is evaluated. On extracting the features, image is classified as Normal and FDR. Using GUI, the user can upload the image. There are buttons in GUI, which facilitates the user to extract 2D color channel.

In [6], investigation and proposal of a system that automatically extracts exudates from Diabetic Retinopathy is made. The color images are extracted using a Fuzzy C-means Clustering technique. Gray level Co-occurrence Matrix is used to extract the Feature Vector and then optimized using Particle Swarm Optimization technique. Finally, the selected features are classified into exudates and Non-exudates using recursive Support Vector Classifier.

III. CONCLUSION

Based on the survey made, it can be clearly stated that all the methods discussed above are highly accurate. However, these methods can be implemented for software approach of detecting exudates. As the algorithms are complicated, hardware implementation of the same cannot be suggested. Since, the time consumed by the algorithms is directly proportional to the complexity, these algorithms are time consuming.

IV. Future Scope

As mentioned in the previous section, these algorithms can be time consuming and only limited to software implementation. Thus, a need to develop a time efficient, area efficient hardware architecture, which is equally accurate, arises.

REFERENCES

[1] Atul Kumar, Manish Srivastava, A. K.Sinha."A Segment based Technique for detecting Exudate from Retinal Fundus image", International Journal of Computer Science & Engineering Technology, Volume 2012; 3(7): 274–284.

[2] *Venkatesh, Pradeep, Sharma, Reetika, Vashist, Nagender, Vohra, Rajpal; Garg, Satpal (2012-09-08).* "Detection of retinal lesions in diabetic retinopathy: comparative evaluation of 7-field digital color photography versus red-free photography", International Ophthalmology.

[3] P. Ravivarma1, B. Ramasubramanian, G. Arunmani, B. Babumohan,. "An Efficient System for the Detection of Exudates in Colour Fundus Images using Image Processing technique ".2014 IEEE International Conference on Advanced Communication Control and Computing Technologies (ICACCCT) .

[4] Mahendran. G, Dhanasekaran. R. Narmadha, Devi, K.N." Morphological Process based Segmentation for the Detection of Exudates from the Retinal Images of Diabetic Patients ".2014 IEEE International Conference on Advanced Communication Control and Computing Technologies (ICACCCT) .

[5] Deepashree Devaraj, Dr. Prasanna Kumar S.C."Blood Vessels Segmentation with GUI in Digital Fundus Images for Automated detection of Diabetic Retinopathy", 2014 International Conference on Contemporary Computing and Informatics (IC3I).

[6] Priyadarshini Patil, Pooja Shettar, Prashant Narayankar, Mayur Patil."An Efficient Method of Detecting Exudates in Diabetic Retinopathy: Using Texture Edge Features ".2016 Intl. Conference on Advances in Computing, Communications and Informatics (ICACCI), Sept. 21-24, 2016, Jaipur, India.

